

AMSAT SATELLITE REPORT

Number 43/44
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Phase IIIB Schedule Keyed To ESA Failure Report

The Board of Inquiry commissioned by ESA, the European Space Agency, to report on the cause of the L5 launch failure last September 9 is due to complete its work by mid-October according to authoritative sources in Paris, ESA Headquarters. Initial estimates made shortly after the demise of L5 were that a one to two month slip-page in an already very tight schedule might be anticipated. This estimate presumed that the initial finding that a third stage turbopump failure was responsible for the L5 loss would be confirmed. Analysis of the telemetry recorded at the time of failure seemed to point to a gear failure as the cause. At 275 seconds into the third stage burn a slight drop in turbopump speed was noted. However, one second later the pump's speed dropped radically from 60,000 to 30,000 RPM. By 325 seconds into third stage burn the speed had fallen to zero and the doomed bird was on the way into the Atlantic to impact north of Ascension Island.

The Board of Inquiry's main task is to determine the cause of the failure and to determine if there is a design improvement required. Rescheduling of future launches depends critically on the Board's findings.

Impact to the AMSAT Phase IIIB launch was indeterminate at press time but there were some interesting possibilities aired. It is known that the payload satellite of L6, Exosat, has a critical launch window. It cannot be launched between 23 January and sometime in May, 1983. If the delay in getting Ariane back on track causes L6 to slip from its presently planned "late November" to after close of the launch window 23 January, ESA may want to swap L7 ahead of L6. AMSAT's Phase IIIB is aboard L7 as is the European Communications Satellite (ECS-1). Exosat is a cosmic X-ray research satellite that must be launched in a specific window. The two satellites aboard L7 are less time-critical and ESA may want to avail itself of the flexibility of the L7 payload to relieve a growing congestion in its launch schedule. The schedule becomes especially tight late in 1983 when the first major commercial launches are due with big paying customers at stake.

ASR has learned that replacements for the two lost satellites aboard the ill-fated L5 mission have not been decided upon. MARECS-B was insured for \$20 million but that figure is well below the replacement value of

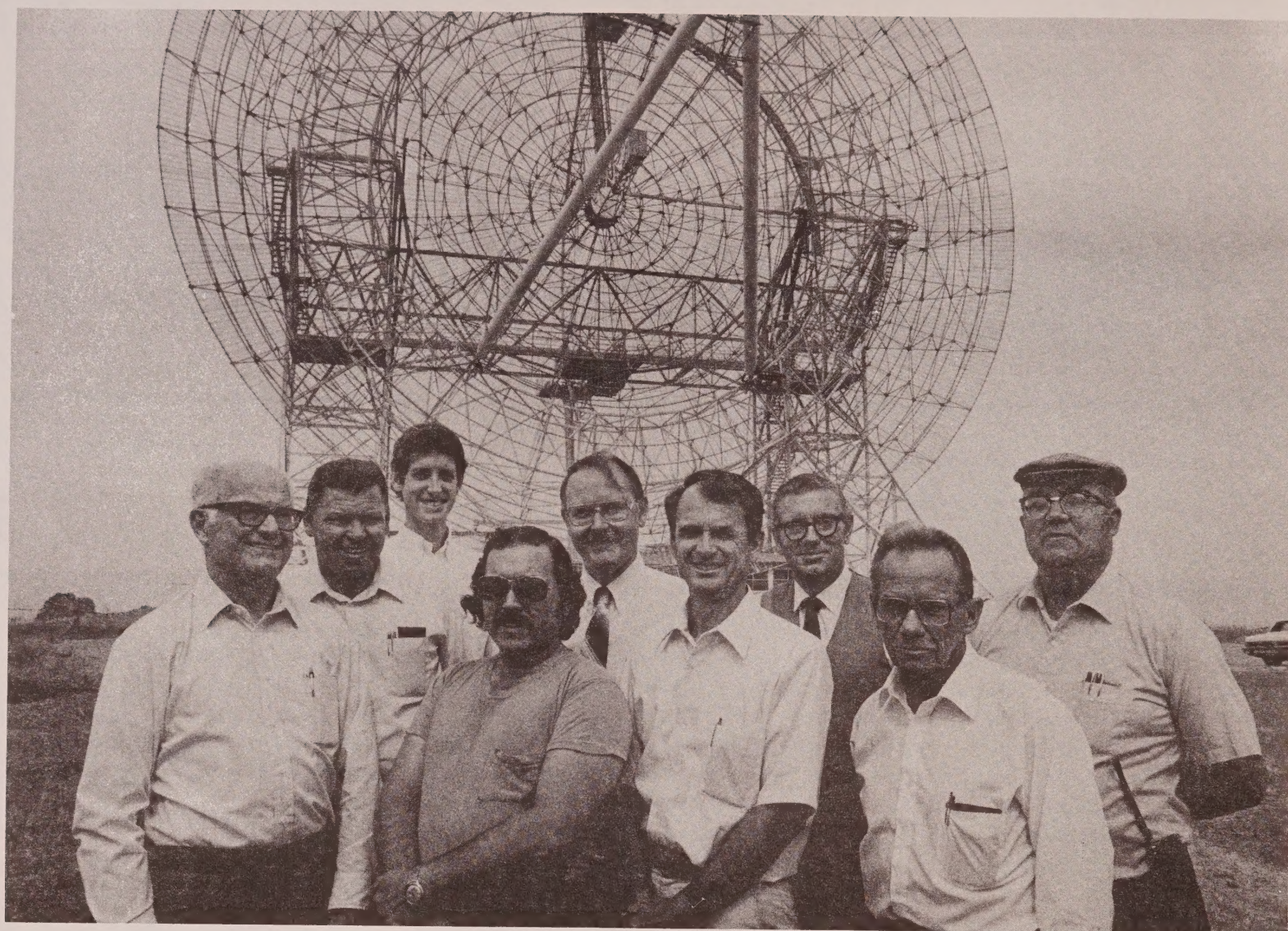
the spacecraft. Sirio 2 was not insured. Sources say it is customary that European scientific satellites not be insured. Sirio 2 was an Italian spacecraft intended to transmit weather data over Africa and included an experiment called LASSO which was designed to aid in the synchronization of atomic clocks around the globe.

AMSAT officials contacted by ASR commented that Phase IIIB could be ready to fly in January 83 if ESA decides to swap L6 and L7 in the schedule. The Phase IIIB satellite is presently in Munich, West Germany, undergoing the final series of tests. This battery of tests included the shock and vibration tests as well as a final round of thermal vacuum tests. These tests are often referred to as the "Shake and Bake" series designed to wring out the systems and optimize reliability.

Telemetry Reports Healthy UoSAT

Stations around the world got back to the fun of watching UoSAT this past week as the amateur scientific satellite renewed its promise of new vistas in amateur science and education. Sending its "medical chart" via its 2 meter telemetry beacon, UO-9 appeared in good health. Program Manager at Surrey, Dr. Martin Sweeting, G3YJO, said last week that all of the parameters appeared favorable with the possible exception of the radiation experiment EHT voltage (channel 13) which had been a bit lower than had been expected. The plan is to run the UO-9 for a few days with the CCD imaging memory on to detect any possible effects of radiation exposure as has been predicted for the long term. Damage from various radiation sources is a major source of concern in the design of satellites. Phase IIIB, for example, will be subject to doses of radiation in the van Allen belts which would be lethal to a human many times over. The UoSAT is expected to not be exposed to heavy radiation exposure except for an occasional solar outburst when particle influx over the poles increases dramatically. The memories aboard UoSAT are generally thought to be the most susceptible to radiation damage so they provide a relative index to the general health of the entire spacecraft.

Soon the stabilization regime will recommence from where it left off abruptly last April. Earlier it had been



The team that successfully rescued UoSAT-OSCAR 9 from its catatonic state on Monday the 20th of September 1982. The team members from left to right are: Roy A. Long, W6YBL; Robert S. Leonard, KD6DG; Robert C. Livingston, KB6LZ; Gilbert M. Roach, W6MXI; Douglas D. Lee, K6TDR; Gary H. Price, W6IRA; Karl E. Lind, KE6D; Howard M. Zeidler, W6WMC; Henry D. Olson, W6GXN.

reported that the gravity gradient boom had been partially deployed last April but current telemetry indicates that the tip mass has not been uncaged (telemetry status point 29 = 0) yet. It is not clear if the 2.5 kg tip mass can be recaged or if earlier reports were in error. Nevertheless plans are proceeding on all fronts to make maximum use of the year to two years remaining in the useful life of UoSAT-OSCAR 9.

In related developments AMSAT UK Secretary Ron Broadbent, G3AAJ, appearing on the Radio Netherlands radio broadcast "Media Network," indicates that he expects UoSAT to exercise the balance of its on-board experiments soon. Although the CCD camera has been on briefly and has revealed a very rough image on its first shot, this experiment is the one which seems to have the widest general appeal despite its dubious scientific merit. On the other hand, the hf beacons (7.05, 14.002, 21.002 and 29.510 MHz) have notable amateur scientific appeal while failing to stir the imagination of most hard-boiled, show-me, hams. With UO-9 back on track and prospects brighter than ever for a meaningful regime of experiments, G3AAJ and crew are expected to once again trot out the CCD camera demodulator and display boards for use by amateurs. Placed between one's vhf or uhf receiver and one's commercial TV appliance, we are told these clever little devices will display the UO-9 CCD

imagery when it is activated. The CCD camera can be activated after the stabilization is complete. Also, once the boom is fully deployed the hf beacons can be activated since they use the 50 foot (16 meter) structure as a linear antenna.

John Beanland, G3BVU/W3 and Ian Ashley, ZL1AOX both report that UoSAT forms the theme of the August/September issue of the British engineering "Journal of the Institute of Electrical and Radio Engineers (IERE)." Papers by the experimenters including G3YJO, LUHBG/W3 et al appear. ASR is obtaining the issue and if the publishers allow, will include key abstracts soon. Watch also for possible inclusion of abstracts in *ORBIT*.

Meanwhile, ASR has transcribed UO-9 telemetry at 1200 baud. We note with chagrin how quickly data accumulates at that rate! At about 100 lines per minute, the telemetry of just a few ten minute passes is enough to fuel the fires for hours. In fact, ASR has undertaken to reuse the printouts in a cost-effective way. We just roll them up, dip them in parafin and use 'em for fireplace logs! Oh well. We moaned when there was no telemetry. A few frames of telemetry from Sunday, 3 Oct. 82 are included herein.

Landmark Meeting Convenes In Paris

Amateur Satellite builders from several nations met in Paris October 2 through 4. According to AMSAT President Dr. Tom Clark, W3IWI, the meeting's main purpose was to explore avenues of mutual cooperation in future amateur space endeavors. Jon (Edmond) Gruau, F8ZS, of France's RACE amateur satellite organization, hosted the meeting. Arrangements for this important convocation have been quietly under way for nearly a year. International political considerations dictated a quiet approach according to informed sources.

It is understood that invitations were sent to individuals in all nations known to have a viable amateur spacecraft construction capability. At press time it was expected that individuals representing 8 nations would attend. These are West Germany, Great Britain, South Africa, Japan, Hungary, France and the United States with Swedish representatives having been granted special observer status by virtue of its near-term potential capabilities. Additionally an invitation was sent to the USSR but it was unclear as ASR went to press that a representative of the USSR would attend. It is

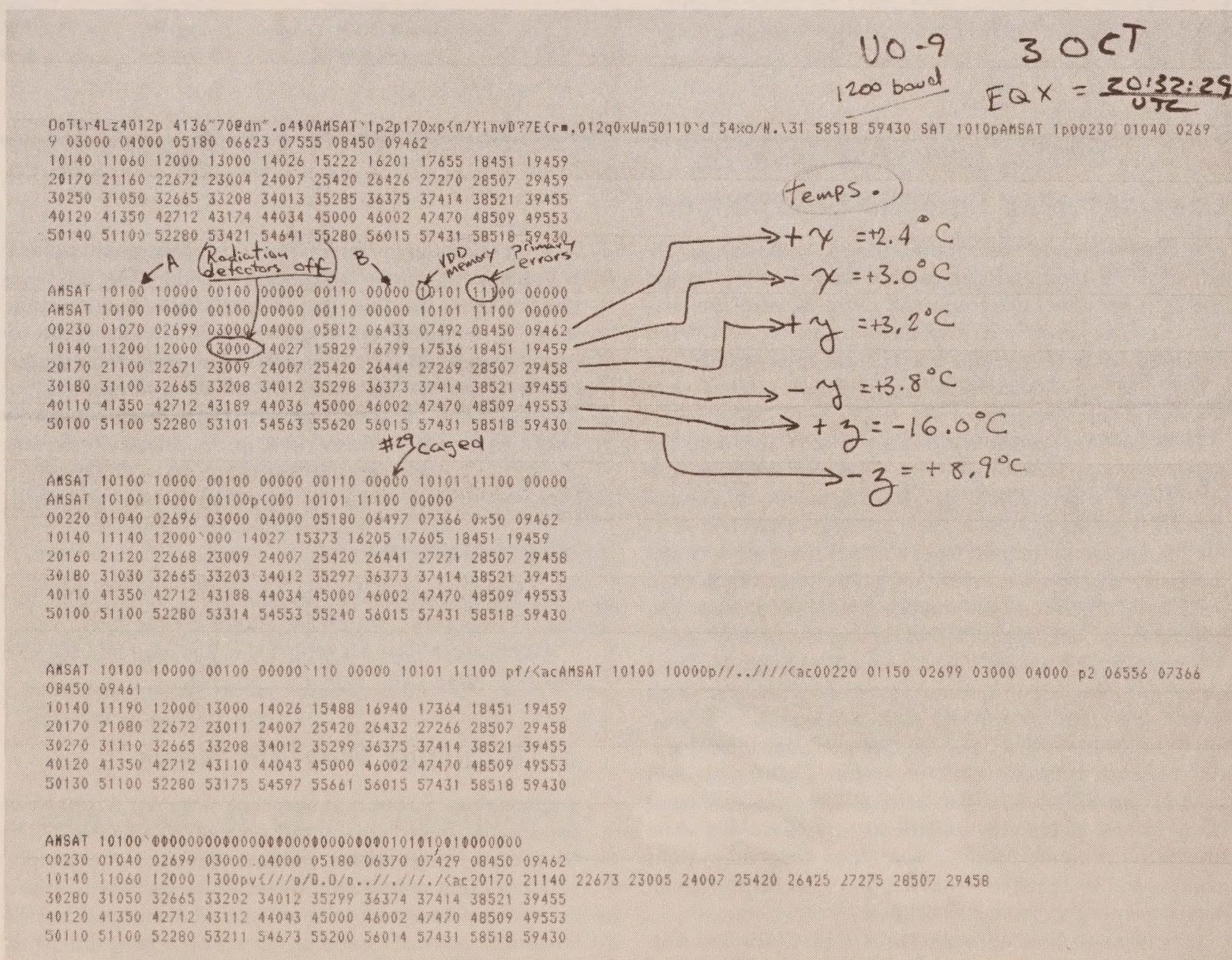
understood that the Federation of Radio Sport had requested state officials permit a representative to attend. Based on recent joint space efforts between France and the USSR (which saw a French Cosmonaut join his Soviet counterpart aboard Salyut 7 recently) there was optimism expressed that the builders of the Radio Sputniks would be represented.

The meeting had, by prior agreement, been strictly limited to hardware constructors rather than include various amateur satellite organizational managers and administrators. This had the dual purpose of keeping the meeting small and manageable and second to reduce potential political and diplomatic snafus often associated with international meetings.

On the agenda were topics such as the growing national space capabilities in several nations, making best use of known launches and joint spacecraft construction projects.

A future ASR will detail meeting discussions and will be supplemented by photos of this important event in amateur radio history.

WA2LQQ worksheet showing UoSAT Telemetry, 1200 baud, 3 Oct. 82. Equations, see page 8.



Reference Orbits, 5 October 1982

Satellite Designation	Time of Ref Orbit	Long. (Deg)	Period (Min)	Incr. (Deg)
AO-7	01:19:15	111.03	114.939382	28.736922
AO-8	00:02:22	76.13	103.172311	25.795440
UO-9	01:00:46	149.02	94.965351	23.741031
RS-3	01:07:56	272.86	118.519719	29.756646
RS-4	01:06:22	269.65	119.394564	29.975490
RS-5	00:32:23	260.66	119.555309	30.015732
RS-6	00:57:27	269.60	118.717115	29.806026
RS-7	01:23:19	274.61	119.196171	29.925890
RS-8	00:50:22	264.59	119.765139	30.068747

Keplerian Elements

	RS-3	RS-4
Element Set #	35	54
Ref. Epoch	82 249.15797890	82 269.58893585
1st Der. Mean Mot.	-.00000034	-.00000063
Inclination	82.9611	82.9619
RAAN	133.5321	124.9407
Eccentricity	0.0058016	0.0017332
Arg. of Perigee	269.8385	290.0576
Mean Anomaly	89.6032	69.8601
Mean Motion	12.15573132	12.06652081
Rev. # of Ref. Epoch	3192	3415
Date of Predict	30 Sept. 82	30 Sept. 82

Offset from the Project OSCAR Calendar

A + indicates add to the Calendar; a - means subtract; an * indicates less than 1 degree.

Satellite Designation	Time Offset (Seconds)	Long. Offset (Degrees)
AO-7	N.A.	N.A.
AO-8	+ 327	+1.5
UO-9	N.A.	N.A.
RS-3	+ 62	*
RS-4	- 7	*
RS-5	- 90	*
RS-6	- 29	*
RS-7	+ 24	*
RS-8	+ 26	*

	AO-7	AO-8
Element Set #	473	693
Ref. Epoch	82 271.43005972	82 269.54721075
1st Der. Mean Mot.	0.00000010	-.00000096
Inclination	101.4034	98.7739
RAAN	275.8201	289.7509
Eccentricity	0.0012357	0.0006935
Arg. of Perigee	32.2854	345.2803
Mean Anomaly	327.8986	14.8198
Mean Motion	12.53376901	13.96484399
Rev. # of Ref. Epoch	36003	23244
Date of Predict	30 Sept. 82	1 Oct. 82

Loss of Indian Satellite Unexplained

A communication and meteorological satellite launched April 10, 1982 and designed to serve India and the sub-continent was deactivated 4 Sept. 82 after the station keeping fuel was depleted. Insat 1A had been designed for a seven year life but got into serious, yet unexplained, difficulty following its anticipated passage through a solar eclipse.

Built by Ford Aerospace of Palo Alto, California, the Insat 1A is a geosynchronous satellite with a momentum wheel and bipropellant gas thruster attitude control system. The bipropellants were completely expended as the spacecraft emerged from the eclipse but it is not presently known what condition gave rise to the sudden instability which required momentum wheel spinup. The bipropellants are monomethyl hydrazine and nitrogen tetroxide. Ford attained a 40 Kg weight saving by using a common integrated tanking system for apogee kick motor, attitude control and station keeping functions. Six 5 lb. thrusters are used for attitude control and station keeping. Without fuel the satellite's attitude would be uncontrollable and so officials of India's Space Department opted to deactivate the satellite. The telemetry is being studied for clues that may yield answers to the puzzle of what happened to Insat while in or after emerging from the eclipse.

In a related development, Dr. Arthur C. Clarke, AMSAT Life Member 2001, in a letter to ASR was "saddened

hear on the radio yesterday morning of the death of Insat 1. Too bad, as a lot of work went into that." Dr. Clarke is Chancellor of the University of Moratuwa, Sri Lanka and recently received the Eighth Marconi Fellowship for Communications, Science and Technology for his unique contributions to the invention of the communications satellite. (See ASR #38.) Insat 1A would have served Sri Lanka (4S7, formerly Ceylon) in its primary coverage zone.

Short Bursts

UA3CR is expected to be operating from North Pole site 25 very soon. Watch for 4K0CR on the birds.

KW6P and WD4FAB report the transponders on RS-5 and RS-7 have been activated recently.

AO-8 Carries Westlink News

Beginning 25 Sept., the Westlink Amateur Radio News Service has been transmitted on AMSAT-OSCAR 8. The 10 minute audio tapes contain news of the general amateur radio community. Westlink News Service is produced as a service to hams around the world by Bill Pasternak, WA6ITF, and others. Bill is also Editor of *Westlink Report*, the bi-weekly newsletter superceding

RS-5	RS-6	RS-7	RS-8
45	32	59	133
82 262.16480932	82 268.22922800	82 271.51863001	82 272.04675472
0.00000076	0.00000003	0.00000100	0.00000201
82.9588	82.9586	82.9576	82.9562
129.4189	123.5694	123.1984	124.6265
0.0010075	0.0049022	0.0021161	0.0019809
343.1672	242.6313	248.2804	355.8856
16.9070	116.9748	111.6003	4.2026
12.05031478	12.13547862	12.08668327	12.02924776
3321	3418	3444	3434
30 Sept. 82	30 Sept. 82	30 Sept. 82	30 Sept. 82

UO-9
294
82 272.37157937
0.00012906
97.5076
233.9456
0.0004777
125.3562
234.8320
15.17478657
5417
30 Sept. 82

ASR Orbital Predictions

Ham Radio Report.

The AO-8 transmissions of Westlink will take place on the last orbit of every Saturday UTC. In initial trials it was found that the Sunday reference orbit offered inadequate visibility windows from the U.S. East Coast for the 10 minute transmissions. Thus, future transmissions will be one orbit earlier. Downlink frequency is 435.195 MHz, LSB, Doppler corrected for the origination QTH of WA2LQQ. The experimental service will continue indefinitely as a precedent to Phase IIIB bulletin service.

Also being considered is the transmission of ARRL W1AW bulletins on AO-8. Details of this project are yet to be worked out.

The Westlink Amateur Radio News Service needs your support to function. Appreciation (\$) may be sent to: Westlink, P.O. Box 463, Pasadena, CA 91102.

Other regional bulletin service is encouraged. Contact K1HTV at AMSAT HQ.

Joint Hamfest Effort Spurs Interest

The Silver Anniversary Hamfest of the Warren Amateur Radio Association of Warren, Ohio, was held this August 15th. AMSAT satellite seminars were given by Bill Clepper, W3HV, and John Champa, K8OCL. Bill is AMSAT's Area Coordinator for northwestern Penn-

sylvania and John handles the Area Coordinator slot in northeastern Ohio. Bill had been a guest speaker in prior years but this time he and John thought to pool their talents with the result being a most enjoyable series of talks for the interested satellite neophyte and would-be satellite user.

The seminars saw W3HV host a program featuring the new AMSAT video tape. Later K8OCL spoke to a set of 35mm slides which was produced by K6UGX and supplemented by some additional slides from the archives of W4PUJ. W8KBF, Sam Hevener, helped out at the booth and was available to answer questions and provide promotional literature. A number of new members joined up at the hamfest and we welcome those new ASR subscribers who signed up and are now reading their first issue of hamdom's finest newsletter!

According to K8OCL, several thousand turned out for this major event in the calendar of Pennsylvania and Ohio amateurs. AMSAT and ASR congratulates all those who represented AMSAT at this 25th Anniversary Hamfest. John adds that the welcome received by AMSAT members and speakers at the affair virtually assures AMSAT's annual participation.

In addition to acting as NW Pennsylvania Area Coordinator, W3HV also serves ARRL in the capacity of AO-8 command station. K8OCL also wears two hats. In addition to being NE Ohio Area Coordinator, K8OCL is AMSAT's liaison to the World Space Foundation, the Solar Sail Project folks!

Radio Netherlands Features Amateur Interest

For some months now Radio Netherlands has been featuring programs of interest to Amateur Radio operators as well as amateur computer hobbyists. Recently, AMSAT'S European Regional Coordinator and AMSAT Director Pat Gowen, G3IOR, of Norwich, England, was interviewed on the air for an international broadcast on Amateur Radio and satellites. Pat recently remarked that he'd "always wondered what it would be like to modulate a megawatt or two!"

In the hobby computer domain, Radio Netherlands is promoting a system called "hobbyscoop." Used in conjunction with broadcasts from Radio Netherlands, this system would "pre-condition" as many as 11 different personal computer types to be compatible with the distribution of software through Radio Netherlands. Mr. Jonathan Marks of the English Section of Radio Netherlands says in a recent correspondence with W6HDO that "A handbook is at present being prepared in both English and Dutch to explain the standard [coding] and a cassette is also being produced to enable easy loading of the translation and example programs into [about] 11 brands of home computers.

A program of potential interest to ASR readers is broadcast weekly on the hf bands. Mr. Marks hosts the program beginning at 0530 UTC, Fridays. The frequencies on which to listen are: 6165 kHz and 9590 kHz. Tks W6HDO.

AMSAT Administrative Slots Being Vacated

Vice President for Operations Rich Zwirko, K1HTV, announces that AMSAT's QSL Bureau Manager and New Jersey Area Coordinator, WB2LCC, has asked to step down from those positions effective with the designation of replacements. WB2LCC, Bill Luebkekmann of Marlton, New Jersey, has served AMSAT for nearly four years in those positions. Bill was recently re-elected as ARRL Sections Communications Manager (SCM) for Southern New Jersey. Bill says that his business interests have increased in complexity and time requirements and he feels that he can no longer do the jobs justice.

AMSAT seeks to fill these vacancies quickly so that Bill can obtain some well-earned relief and that the tasks be picked up promptly by new volunteers. The QSL Bureau Manager functions as the primary mail drop for OSCAR QSL cards. The Bureau typically processes several thousand QSLs per year. Potential volunteers should contact Rich Zwirko, K1HTV, at P.O. Box 27, Washington, DC 20044. Rich will call you by landline if you care to discuss the QSL Bureau Manager's responsibilities. Be sure to include your telephone number(s) if you want to be called. Also indicate best time of day to call.

The Area Coordinator for New Jersey was also filled by WB2LCC. K1HTV would like to hear from potential volunteers for this important position as well. Previous remarks regarding contact with K1HTV apply here as well.

These positions are important functions within the Operations Branch and WB2LCC has assured all that he will provide continuity and transition until a new volunteer comes on line. AMSAT owes Bill a large chunk of thanks for his selfless years of service to others in AMSAT. It seems appropriate that those who have received service from Bill write to him now on his retirement in thanks. Better late than never. Thanks WB2LCC!

SARSAT Rescue Tokens Satellite Co-op, Recalls AO-7

A satellite-based system for locating downed airmen has made its first save according to Canadian authorities who used the pre-operational version to save the lives of three would-be rescuers who themselves became victims. Search and Rescue Satellite (SARSAT) is a new system that uses polar orbiting satellites to listen for the Emergency Locator Transmitter (ELT) of downed aircraft on 121.5 and 243 MHz. Participating in the program are the U.S., France, USSR and Canada. The save was made over northern British Columbia, Canada, 10 Sept. 82 using a Soviet spacecraft, Cosmos 1383, a standard navigation satellite carrying the SARSAT transponders as extra baggage.

AMSAT helped pioneer the SARSAT system using AMSAT-OSCAR 7 in December 1975 when, among others AMSAT's Tom Clark, now W3IWI, and Jan King, W3GEY,

helped organize and execute the pivotal experiments which amounted to a "proof of concept" demonstration. (See AMSAT Newsletter, Vol. VIII, No. 1, March 76.)

The Canadian rescue began with the crash 9 Sept. of a Cessna 172 in northern British Columbia. The aircraft had itself been on a rescue mission looking for an aircraft lost in July when the rescue aircraft crashed into 50 foot high trees. The three crewmen aboard were seriously injured but thanks to the prompt location and rescue will survive.

The Cosmos 1383 was launched from Plesetsk 1 July into a nearly circular 1000 km (610 mile) orbit inclined 83 degrees. The orbital inclination is identical to the new RS birds but the altitude of Cosmos 1383 is only 65% of the RS's. The SARSAT spacecraft overfly a downed aircraft and relay the ELT beacon through the spacecraft transponder to listening ground stations. The ground stations use the observed Doppler shift of the ELT to compute the location of the source (aircraft). In the Canadian rescue, Canadian Forces personnel at the Rescue Coordination Center in Victoria, British Columbia contacted the Rescue Coordination Center in Trenton, Ontario where the satellite rescue coordination facility is located. The engineers quickly determined that a suitable orbit would occur on 10 September; the next day. At the expected time the ELT from the downed aircraft was monitored at Trenton. The location of the ELT was quickly computed and a Canadian Forces de Havilland of Canada Buffalo rescue aircraft was immediately dispatched from Comox, British Columbia. The wreck was quickly located and the three injured occupants, one very nearly in shock, were rescued. Canadian officials credit the SARSAT with saving the lives of the three crewmen and reducing the cost of the rescue operation.

This was the first reported use of the SARSAT which is not yet fully operational but rather in the late stages of engineering development. AMSAT is proud of having participated in the early stages of the SARSAT system. All amateurs may take pride in knowing that the seeds of this humanitarian, international system were sown on our own AMSAT-OSCAR 7! The U.S. spacecraft element of the SARSAT system will be launched in February, 1983, as part of the NOAA-E package.

FLASH—It now appears likely that, as a consequence of the Ariane L5 failure, the AMSAT Phase IIIB and ECS-1 satellite payloads will be moved from the L7 launch vehicle to L6. L6 will likely be launched mid-February 1983.

ASR's Spotlight On: W8GQW



Wray Dudley, W8GQW, AMSAT's manager of hf net operations, is another of the old-timers who look upon retirement as an opportunity to be of service to his fellow hams.

Wray has been a licensed ham for 51 years, somewhat unusual, but what is unusual is the fact he has held the same call for all those years despite what appeared to be a move from one call area to another shortly after World War II.

In recent years, such a move has not required a call change, but for most of U.S. hamdom's existence, a move to a new call area mandated a new set of call letters.

When Wray was first licensed, his hometown, Pittsburgh, Pa., was in the 8th call area, but coincidental with the inception of WØ, shortly after World War II, Pennsylvania became a part of W3. In the meantime, Wray had moved to Troy, Ohio, solidly in W8-land. Troy, by the way, is only about 20 miles from Dayton.

Wray and his wife, Lois, have three daughters, now grown and gone. Once an excellent golfer, Wray says he still enjoys the game and plays a lot, but doesn't score quite as well as he once did. Part of the decline may be attributed to a deep, time-consuming interest in orbital mechanics and all the other matters that go to make up the amateur satellite scene.

Wray's pride and joy in the pre-war era was an outstanding signal on 40 meters emanating from a 204A driven by a 203A in turn driven by a crystal oscillator and various doublers and buffers. The 204A looked something like a rolling pin and was rated to handle somewhat more than 600 watts, but only up to 3 MHz. Phone activities then were confined to a loop-modulated AM rig on 160 and occasionally on 75 meters. We won't go into the techniques of loop modulation except to say it was mighty hard on the carbon microphones so popular in that era.

Then came the war and Wray enlisted in the Army Air Corps cadet program, from which he emerged as a full-fledged pilot. But, as the holder of a degree in mechanical engineering, he was put to work as a maintenance officer.

After the war, Wray went to work for a manufacturer of complex sprinkler equipment and later for the Hobart Corp., from which he retired three years ago as vice president.

Postwar ham activities included cw at first, then AM phone, and, in 1954, sideband with a Central Electronics 10B exciter and a pair of 811s. "You had to hunt for someone to talk to in those days," Wray said.

He became interested in satellites early, when OSCAR 1 was emitting its "hi," but didn't really get into the satellite act until retirement. Wray is a Mode J fan, using an Icom 211 uplink and an Icom 451 on downlink. His antennas are home-brew, with az-el control. For two meters he uses a five-element quad, and for 70 cm a 10-turn helix which Wray says took three months to build and a week and a half to tweak. The matching system for the helix came straight from Mr. Helix himself, John Kraus, W8JK.

Wray's involvement with hf net management began when he "stuck his neck out" and responded to a call for help from WA2LQQ early in 1981. Then, a trip to Washington on other business resulted in a visit to Goddard and lunch with Jan King, W3GEY, and that superlative talent scout, AMSAT President Tom Clark, W3IWI. Wray agreed to take the net manager job.

He says he enjoys the assignment, but gives much credit to net control stations such as Jim McKim, WØCY, Vern Riortella, WA2LQQ, Harry Bluestein, N6TE, Bud Schultz, W6CG, Dave Lieberman, XE1PU and others for the smooth functioning of the AMSAT HF communications system. Wray's biggest concern is getting more people, especially the younger group, active in net control roles.

"God knows we need them, (the young) and we've got to develop desire and enthusiasm in that group. We must rely on them. Who is next when we're gone?" Wray asked.

In the meantime, however, satellite aficionados can be sure that their hf net communications are, to paraphrase an insurance company, "in good hands with Wray Dudley."

Revised UoSAT Telemetry Sensor Points, Calibrated After Launch

Telemetry Sensor Allocation:

Channel	Parameter	Range	Cal. Equation
00	Secondary S/C Computer (F100L)	0 - 1A	$I = 1.2N \text{ mA} (0.125A \text{ } I \text{ } 1A)$
01	Solar Array Current + X	0 - 2A	$I = 1.12N + 200(\text{for } I_s \text{ less than } 200 \text{ mA})$
02	Battery Half Voltage	0 - 10V	$V = N/100 * (1.01)$
03	Radiation Detector A O/P	0 - 5V	$\text{Count} = 40N * (1.04)$
04	Radiation Detector B O/P	0 - 5V	$\text{Count} = 40N * (1.04)$
05	Magnetometer Expt. HX-Coarse	0 - 5V	$V = N/200 * (1.01)$
06	Magnetometer Expt. HY-Coarse	0 - 5V	$V = N/200 * (1.01)$
07	Magnetometer Expt. HZ-Coarse	0 - 5V	$V = N/200 * (1.01)$
08	Battery Pack-A Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
09	Spacecraft Facet Temperature + X	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
10	Visual Display Expt. & CCD Current	0 - 1A	$I = 1.2 * (N - 30 \text{ mA } (0.15A \text{ } I \text{ } 1a)$
11	Solar Array Current + Y	0 - 2A	$I = 1.12N + 200(\text{for } I_s \text{ less than } 200 \text{ mA})$
12	2.4 GHz Beacon Expt. Power O/P	0 - 2000mW	$P = (N - 99) * 0.633 \text{ mW}$
13	Radiation Detectors Expt. EHT Volts	0 - 1000V	$V = N \text{ volts}$
14	Radiation Detectors Expt. Current	0 - 250 mA	$I = (N + 20)/8 * (0.983) \text{ mA}$
15	Magnetometer Expt HX-Fine	0 - 5V	$V = N/200 * (1.01)$
16	Magnetometer Expt. HY-Fine	0 - 5V	$V = N/200 * (1.01)$
17	Magnetometer Expt. HZ-Fine	0 - 5V	$V = N/200 * (1.01)$
18	Battery Pack-B Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
19	Spacecraft Facet Temperature - X	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
20	Spacecraft Computer Current	0 - 1A	$I = 1.2 * (N - 25) \text{ mA } (0.125A \text{ } I \text{ } 1A)$
21	Solar Array Current - X	0 - 2A	$I = 1.12N + 200(\text{for } I_s \text{ less than } 200 \text{ mA})$
22	Battery/BCR + 14V Bus	0 - 20V	$V = N/50 * (1.056)$
23	Sun Sensor + Z Axis	0 - 5V	$V = N/200 * (1.01)$
24	10.4 GHz Beacon Expt. Current	0 - 250 mA	$(N - 40)/4 * 0.97$
25	Magnetometer Expt. Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
26	Magnetometer Expt. Current	0 - 250 mA	$(N/8) * 0.9945$
27	Telecommand Receiver Current	0 - 250 mA	$I = (N - 16)/8 * (0.952) \text{ mA}$
28	Module Box Assy. Temperature + X1	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
29	Spacecraft Facet Temperature + Y	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
30	Battery Charge Current	0 to + 5A	$I = 3N \text{ mA}$
31	Solar Array Current - Y	0 - 2A	$I = 1.12N + 200(\text{for } I_s \text{ less than } 200 \text{ mA})$
32	Power Conditioning Module + 10V	0 - 20V	$V = N/60 * (0.93)$
33	Telemetry System Current	0 - 20 mA	$I = (N - 16)/30 * (1.084) \text{ mA}$
34	2.4 GHz Beacon Expt. Current	0 - 250 mA	$I = 0.4 * (N - 11) * (1.072) \text{ mA}$
35	145 MHz Data Beacon Power O/P	0 - 2000mW	$P = (N - 82) * 1.67$
36	145 MHz Data Beacon Current	0 - 250 mA	$I = (N - 7)/4 * 1.014$
37	145 MHz Data Beacon Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
38	Module Box Assy. Temperature - X1	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
39	Spacecraft Facet Temperature - Y	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
40	+ 14V Line Current	0 - 5A	$I = 2.86N \text{ mA}$
41	+ 5V Line Current	0 - 5A	$I = 1.28(N - 50) \text{ mA } (0.075A \text{ } I \text{ } 1A)$
42	Power Conditioning Module + 5V	0 - 10V	$V = 2N/300 * (1.12)$
43	Sun Sensor - Z Axis	0 - 5V	$V = N/200 * (1.01)$
44	HF Beacons Expt. Current	0 - 250 mA	$I = (N - 36)/3 * 1.038 \text{ mA}$
45	435 MHz Data Beacon Power O/P	0 - 2000mW	$P = (N - 102) * 1.792$
46	435 MHz Data Beacon Current	0 - 250 mA	$I = (N - 34)/3 * 1.053 \text{ mA}$
47	435 MHz Beacon Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
48	Module Box Assy. Temperature + Y1	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
49	Spacecraft Facet Temperature + Z	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
50	+ 10V Line Current	0 - 5A	$I = 3N \text{ mA}$
51	- 10V Line Current	0 - 5A	$I = 1.3 * (N - 60) \text{ mA}$
52	Power Conditioning Module - 10V	0 - - 20V	$V = 0.0158N - 0.0224 * N('N' \text{ of } + 10v \text{ line})$
53	Naviagation Magnetometer X-Axis	0 - 5V	$V = N/200 * (1.01) \uparrow$
54	Navigation Magnetometer Y-Axis	0 - 5V	$V = N/200 * (1.01) \uparrow$
55	Navigation Magnetometer Z-Axis	0 - 5V	$V = N/200 * (1.01) \uparrow$
56	Speech Synthesiser Current	0 - 250 mA	$I = (N - 16)/10 * 1.009 \text{ mA}$
57	CCD Imager Temperature	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
58	Module Box Assy. Temperature - Y1	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$
59	Spacecraft Facet Temperature - Z	- 30 to + 50°C	$\text{Temp} = (474 - N)/5 * (1.01) \text{ Degrees C}$

†Determine vector as follows: $B_z = -189.54 * (N_y - 336.55)$ $B_y = +183.486 * (N_x - 663.44)$ $B_x = -194.5 * (N_z - 496.5)$

$$B_t = (B_x^2 + B_y^2 + B_z^2)$$